

# STORM-WATER MANAGEMENT PLAN TECHNICAL MANUAL

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### General

In order to comply with the Stormwater Management Policy adopted by Augusta-Richmond County Commission, the following technical manual has been compiled to provide engineers, developers, land planners, and others information necessary to construct public/private facilities in Augusta. The goal of the stormwater management policy is as follows:

To develop a stormwater management system that is a feasible, constructable system designed to collect, convey and release stormwater in a manner that protects public safety, minimizes damage to all impacted properties, protects water quality, and is maintainable in perpetuity.

The contents of the technical manual have been developed to establish minimum requirements for the design and construction of individual and collective stormwater management systems in Augusta. Furthermore, sound engineering practices and judgement should be applied in the planning and design of all facilities proposed to comply with the stormwater management policy for Augusta-Richmond County Commission. Constructed facilities designed and based on criteria in excess of the minimum established requirements as stated in this technical manual may be necessary in order to effectively control and manage stormwater runoff for newly constructed facilities. Augusta-Richmond County Commission does not assume to provide complete and comprehensive technical review of construction plans and reports submitted for the construction of new facilities but rather provides a general review of information and documentation submitted through the Public Works Engineering Department to generally insure that appropriate documentation of design calculations have been submitted in accordance with the minimum technical criteria stated herein. To this end, the engineer, developer, and land planner shall be responsible for the intent of the stormwater management policy based on actual field conditions and construction techniques.

In the event that exceptions to the minimum requirements should be proposed by the developer, the engineer and designer shall meet with the City Engineer to discuss proposed exceptions to minimum requirements.

## **PART I HYDROLOGY/HYDRAULICS**

### **Section I Determination of Storm Runoff**

#### **1.01 General:**

Determination of stormwater runoff is a complex issue involving existing drainage basin characteristics, future drainage basin characteristics, the relationship of the proposed development to the drainage basin and the characteristics of downstream properties and receiving waters. The most obvious and accurate method of determining runoff for a particular basin area would be to utilize historical data of measured runoff values. However, except in certain, limited, instances, this information is not available. Therefore, establishing runoff data for a particular drainage basin requires the utilization of rainfall - runoff relationships through various hydrology models.

## 1.02

In order to effectively establish rainfall - runoff relationships, basic data concerning the basin and site must be collected and provided in the hydrology/hydraulics report:

Delineation of the drainage basin of which the site is a part. The drainage basin shall be provided at an appropriate scale that can be utilized in the overall hydrology/hydraulics report evaluation. USGS quadrangle maps of the drainage basin area shall be used as a minimum standard map.

A topography map of the site proposed for development shall be provided with 2 foot contour intervals accurate to 1/2 the contour interval. The site topography map shall be provided with sufficient data to determine site characteristics prior to development and following construction of proposed improvements. The site topography map shall be provided at a scale commensurate with construction drawings.

Drainage features, natural or man-made, designed to receive discharge from proposed site improvements shall be identified on the drainage basin map and the site topography map. Sufficient data regarding the drainage features shall be provided to accurately characterize the feature including but not limited to depth, width, side slopes, surface materials, etc.

•Soil characteristics of the proposed developed area as well as immediate downstream receiving areas shall be provided.

## 1.03

Each project designed in Augusta shall comply with the following criteria and guidelines. Construction plans and details are required for review by the City Engineer. A hydrology and hydraulics report of the project and associated basin, as outlined herein, shall be prepared and submitted to the City Engineer for review.

Numerous rainfall - runoff computation methods are available. It is essential that a computation methodology consistent with both site and drainage basin characteristics be selected to design the storm drainage and flood control system. The rational method may be used to determine the flows for sites located in contributing drainage basins less than 100 acres. For drainage basin areas 100 acres or greater, Natural Resources Conservation Service TR-20 and TR-55, or the US Army Corps of Engineers HEC-1 method should be used.

Documentation of runoff generated by the selected methodology shall include data for the 2, 5, 25, 50, and 100 year return frequency storms. Runoff data shall be calculated for the drainage

basin and site both prior to development and after development. For contributing drainage basins 100 acres or greater, the Natural Resources Conservation Service Type II storm for a 24 hour period is required as a minimum.

All rainfall - runoff computations require physical site characteristics expressed in numerical designation. Runoff coefficients utilized for the Rational Method shall be in accordance with the table provided in the Appendix of this manual. Runoff curve numbers as established in the Natural Resources Conservation Service manual for hydraulic computations shall be utilized in SCS computation methods.

The Hydrology/Hydraulic Report of the drainage basin area and site shall include input data, method of analysis, runoff generation, and routing calculations for on-site and off-site subbasin areas.

## **Section II Storm Drains**

### **2.01 General:**

The purpose of this section is to consider the hydraulic aspects of storm drains and their appurtenances in a storm drainage system. Hydraulically, storm drainage systems consist of conduits (open or enclosed) in which unsteady and non-uniform flow exists. The design storm shall be 25-year return frequency storm with evaluation of the overall storm drainage system in the event of 100-year return frequency storm.

### **2.02 Guidelines:**

General rules in minimum design criteria required for public storm drain systems are as follows:

- a. Minimum acceptable pipe size shall be 18 inch diameter.
- b. Do not discharge the contents of a larger pipe into a smaller one even though the capacity of the smaller pipe may be greater due to a steeper slope.
- c. Provide routing calculations for storm drainage system including off-site flows for the 25-year return frequency storm. Hydraulic grade lines for systems should not exceed ground surface elevation at inlets for design storm.
- d. Storm drain should be designed to allow velocities of flow sufficient to prevent deposition of solid materials.

e. For inlet and outlet pipe conditions, headwall shall be constructed in accordance with GA Department of Transportation Standards. All headwalls shall be GA Department of Transportation Construction Standard 1125. Safety end-sections may be utilized for longitudinal pipe located within the right-of-way and F.E.S. for storm drainage pipe located outside right-of-way.

f. Documented appropriate coefficients of roughness for pipe material shall be used in Mannings equation.

## **2.03 Inlets:**

Inlets shall be constructed as part of the storm drainage system to intercept surface water and convey the water to the storm drainage system. The following guidelines shall be used in design of inlets located in streets:

a. Inlets shall be located within the proposed street system based on the drainage area and the overall storm drainage system design.

b. Inlets shall be spaced and sized based on drainage area contributions and bypass quantities.

c. All inlets shall be constructed in accordance with the Georgia Department of Transportation Standards for Construction.

d. Recessed inlets shall not decrease the width of the sidewalk.

e. Design and location of inlets shall take into consideration pedestrian and bicycle traffic. In particular, grate inlets shall be designed to assure safe passage of bicycles.

f. The use of slotted drains in public systems shall not be acceptable unless no other alternatives are available.

g. Storm drainage system plans shall depict the location of all inlets and other storm drainage system structures including, but not limited to manholes, mains, laterals, ditches, culverts, etc.

h. For each inlet, data shall be submitted indicating the drainage area to the inlet, inlet time of concentration, design rainfall frequency, and peak flow.

i. Catch basins shall not be located with radii at street intersections. If stormwater collection is necessary along radius, use Georgia Department of Transportation 1019-A, Type "E". Use multiple grates if volume warrants.

## **Section III. Open Channels**

### **3.01 General:**

Open channels may be designed and constructed as an integral part of the storm drainage system. The benefits of open channel drainage systems related to cost, capacity, or potential storage should be carefully considered in comparison to disadvantages such as easement and right-of-way needs and maintenance cost. Open channels may be classified as natural or man-made. The function and characteristics of these channels may be altered by the addition or construction of channel linings. Three (3) main classifications of channel linings are recognized: vegetative, flexible, and rigid.

### **3.02 Design Guidelines:**

The minimum requirements for the design of open channels shall be based on the following criteria:

- a. Open channels shall be designed to accommodate the 25-year design frequency storm as a minimum. Should open channels be located in areas where rainfalls exceeding the 25-year return frequency storm would cause excessive damage to surrounding properties, additional capacity may be required.
- b. Maximum permissible velocity for grass lined channels is six (6) feet per second for the design storm. Flow velocities shall not exceed six (6) feet per second at transition locations where storm water flow exits onto grass lining. Exceptions may be processed when an approved modeling method such as HEC-15 shows that the channel is stable under the proposed conditions.
- c. Roughness coefficients for the design of open channel drainage systems shall be based on the Natural Resources Conservation Service manual or by the design method.
- d. The minimum slope for grass lined channels shall be one (1%) percent.
- e. Generally in public systems side slopes for grass lined channels shall be three (3) horizontal to one (1) vertical or flatter with the exception of roadside ditches (roadway design standards). Changes in direction of channels shall be accomplished using simple horizontal curves. The centerline curvature shall have

a minimum radius of twice the top width of the design of flow.

f. Concrete lined channels shall be designed to avoid hydraulic jumps. If hydraulic jumps are unavoidable, sufficient freeboard shall be provided. The channel shall be constructed of reinforced concrete.

g. Appropriate energy dissipation devices shall be constructed in channels to control flow velocities.

h. Channel drop structures may be required to reduce channel velocities and reduce upstream and downstream channel slopes. Design of channel drop structures shall be accomplished to contain design flow in channel, maintain allowable velocities and minimize maintenance cost.

### **3.03 Erosion Control:**

Appropriate erosion control methods shall be employed to insure functional operation of the open channel and minimize maintenance cost. The "Manual for Erosion and Sediment Control for Georgia" shall be used for appropriate erosion control methods.

Non-structural erosion control measures are encouraged where feasible. Other structural erosion control measures may include rip-rap, gabions, or other constructed facilities. The designer shall provide adequate calculations to the City Engineer for review of such facilities to determine required velocity control and appropriate soil and erosion control measures

## **Section IV CULVERTS**

### **4.01 General:**

The traditional use of culverts is to convey storm flow through or under an existing structure or facility without causing excessive backwater build-up or overtopping the structure while minimizing excessive downstream velocities. Culvert sections will include upstream approaches, headwalls, culvert piping, outlet headwalls, and downstream energy dissipation/velocity control structures. Unless required by the Augusta-Richmond County Public Works Engineering Department, culverts shall be designed for a 25-year return frequency storm with back water elevations not exceeding a height six (6) inches below the shoulder of the roadway.

### **4.02 Design Guidelines:**

a. Inlet and outlet headwalls shall be Georgia Department of Transportation Construction Standard 1125. Outlet headwalls shall include the energy dissipation

structures.

- b. Additional energy dissipation devices/structures may be required at outlets to control velocity.
- c. Selection of culvert size shall be based on hydraulic calculations for inlet control and outlet control conditions.
- d. For culverts draining greater than four (4) acres of runoff, hydraulic design calculations shall be submitted.
- e. In outlet control conditions, the determination of tail water depth shall be included in the design.
- f. The drainage basin and peak flow for culvert design shall be provided.
- g. A minimum velocity of 2.5 feet per second is required for culverts flowing partially full to minimize sedimentation build-up.

## **Section V DETENTION**

### **5.01 General:**

This Stormwater Management Program has been developed to control increased runoff generated by development of property in the urban, suburban, and rural areas of the county. General impacts of land development include: increased rates and volumes of runoff, increased channel erosion and degradation, increased sedimentation, greater levels of pollution, and lower base flows during non-storm conditions. Augusta requires the design and construction of stormwater management facilities such as detention, retention, infiltration, and sedimentation ponds to address and mitigate the results of urbanization.

In general, stormwater management facilities shall be designed to provide for temporary storage of stormwater runoff. The volume of stormwater runoff collected and stored will then be released at a controlled rate not to exceed the pre-developed peak runoff rate of the site for the equivalent storm. Augusta encourages the use of best management practices in the design and construction of stormwater management facilities, including storage facilities, to minimize the transportation of pollutants, provide for effective erosion control, and minimize the transport of sediment.

### **5.02 Detention Guidelines:**



Stormwater runoff storage facilities shall be designed in accordance with the following minimum criteria; depending on project location, basin characteristics, and evaluation of project impacts by the City Engineer, additional requirements or support documentation may be necessary.

- a. Storage facilities shall be located to collect all runoff from proposed developed areas; justifiable exceptions to allow portions of a development to bypass detention may be made by the City Engineer.
- b. Storage facilities shall not be located within the 100-year flood plain in accordance with the flood plain management policy of the current Augusta-Richmond County Commission Flood Plain ordinance.
- c. Storage facilities shall be designed to provide adequate volume to detain the runoff difference between the pre-developed and post-developed site area for the design storm.
- d. Stormwater runoff data shall include tabular hydrographs of pre-developed and post-developed runoffs for the 2, 5, 25, 50, and 100-year storms.
- e. Outlet structures shall be designed to control the release of stored stormwater runoff not to exceed the pre-development runoff rate for the corresponding storm, based on the 2, 5, 25, and 50-year return frequency storms.
- f. Detailed construction information including plan and cross-section(s) views shall be provided on the outlet structure, including type of structure, type of release control, ie weir and orifice control, etc.
- g. Stage-discharge rating data shall be presented in tabular form with all discharge components, including orifice, weir and outlet conduit flows and velocities clearly indicated.
- h. The bottom area of the storage facility should be sloped towards the outlet to prevent standing water conditions, other methods acceptable to the City Engineer may be used.
- i. Sedimentation control measures shall be installed within the storage facility to prevent transport of settlement into the outlet structure and downstream receiving waters.
- j. For each storm event, a hydrograph routing methodology shall be used to indicate staged-storage-discharge relationships. Routing hydrographs will not be required for storage facilities designed on sites smaller than five (5) acres.

- k. The design of storage facilities that require storage volumes in excess of 100 acre feet or earthen embankments in excess of 25 feet shall be prepared in accordance with the Georgia Safe Dams Act and submitted to the Georgia Department of Natural Resources Safe Dams Division for review.
- l. Slopes of earthen embankments shall be constructed with two (2) horizontal to one (1) vertical dimensions or flatter. Details of embankment construction, including geometry, materials of construction, compaction characteristics, etc. shall be provided.
- m. For embankments in excess of 15 feet in height, design and construction data relating to embankment stability, foundation preparation, and resistance to erosion shall be provided.
- n. Outlet structures shall be designed to provide release of low flow volume and prevent standing water within the detention pond.
- o. An emergency overflow shall be provided for all storage facilities, capable of passing the 100-year return frequency storm unless the 100-year storm is accommodated through the principle spillway/outlet.
- p. Grassing schedule for earthen embankment and exposed soils from construction activities shall be provided.
- q. Trash racks and safety grates will be required for all outlet structures and outlet pipes greater than or equal to 18 inches.
- r. A six (6) foot chain link fence with three (3) strands of barbed wire and 14 foot access gate shall be installed around public detention ponds. Hold Harmless Agreements may be executed by the developer for private systems (see Appendix).
- s. Sheet flow over side banks of the detention pond is discouraged; off-site flow shall be routed to the common locations and conveyed into the stormwater storage facility utilizing structural practices to minimize erosion.
- t. For facilities to be dedicated to Augusta-Richmond County Commission, O-ring RCP shall be required for the entire length of pipes penetrating the embankment or dam; justifiable exceptions may be accepted by the City Engineer.

### **5.03 Exemptions:**

Exemption to stormwater runoff storage requirements may be made on a case-by-case basis within the urban areas of Augusta. In order to apply for an exemption to stated stormwater requirements, the following criteria must be met:

- a. The site must be located within the urban district, or
- b. Proposed changes to the site or proposed development activities produce no change in runoff, or
- c. The site is less than one (1) acre in size and the proposed development does not produce stormwater runoff greater than 1 cfs in excess of pre-developed conditions on a 50-year return frequency storm.

## **Section VI OUTFALL-RUNOFF RELEASE**

### **6.01 General:**

The outfall of stormwater runoff storage facilities directly impacts down stream properties and receiving waters. The location of the outfall structure is therefore crucial in the design of an overall stormwater management system. In general, the outfall from a storage facility should be located to access the nearest natural drainage feature or stormwater conveyance system with adequate capacity to convey released flow from the storage facility. Overflow or emergency spillways designed to accommodate a 100 year return frequency storm may or may not be located near the principal outlet structure depending on capacities and the impact of down stream properties.

### **6.02 Design Guidelines:**

The following information shall be provided for evaluation of the stormwater release locations:

- a. Indicate and label the drainage feature located immediately downstream of the outlet structure.
- b. Indicate the nearest receiving creek, stream or tributary as delineated by FEMA or USGS quadrangle maps and distance to such feature.
- c. Indicate outlet location and discharge flows on plans.
- d. Provide energy dissipation structures to control outlet velocities for erosion control, if necessary.

## **Section VII SPECIAL BASIN RESTRICTIONS**

### **7.01 General:**

Urban development has significantly impacted certain creek drainage basins resulting in serious damage to property and the disruption of infrastructures services to commercial and residential areas within the basin during significant rainfall events. Consequently, these basins have been identified as requiring special consideration in design of residential and commercial developments. The drainage basins identified as requiring additional design consideration are as follows :

- a. Rae's Creek Basin
- b. Rocky Creek Basin
- c. Rock Creek Basin

Within these basins, the following restrictions, shall apply:

For site developments less than ten acres, no fill or detention facilities shall be placed in the flood plain based on a 100 year return frequency storm as established by FEMA

Stormwater management facilities are required for all developments

The release of stormwater runoff from storage facilities shall be limited to 90% of the pre-developed rates

## **Section VIII Detention and Sediment Basin Construction**

### **General:**

Sedimentation control basins and detention ponds and other stormwater management facilities are required for all grading activities, roadway construction, and site development to minimize damage and protect Georgia's lands and water resources. Where practical or at the direction of the City Engineer, such structures shall be constructed immediately following initial clearing and grubbing activities. In all cases, structures are considered to be a part of the soil erosion and sedimentation control practices for the site and shall be installed as soon as practical. Failure to install these structures in a practical sequence or in such cases where failure to install these structures allows mitigation of sediment erosion or other damage to adjacent land or water resources will constitute a violation of the Soil Erosion and Sedimentation Control Plan and

associated ordinance.

## **PART II ENVIRONMENTAL REQUIREMENTS**

### **General:**

All stormwater management plans are required to comply with local, state and federal regulations including environmentally sensitive land areas, "wetlands", stormwater run-off quality, and specific National Pollution Discharge Elimination System, "NPDES" programs. Depending on location and impact on downstream waters from proposed developments, other state and federal regulations may require compliance.

### **Section I WETLANDS**

#### **1.01**

The delineation and jurisdictional approval of wetlands as identified under Section 404 of the Clean Water Act is regulated by the US Army Corps of Engineers. For projects located in Augusta, the Savannah office of US Army Corp of Engineers provides review and enforcement activities. Although compliance of section 404 of the Clean Water Act is the responsibility of the property owner, Augusta-Richmond County Commission is dedicated to insuring the protection of natural resources and working with the Corps of Engineers in identifying, accessing and evaluating the impact of proposed developments on a existing wetland areas. Should characteristics typical of wetland be identified within a specific project area, the City Engineer may request additional information concerning the impact of the proposed development on this area and/or the jurisdictional on delineation of the area.

For projects impacting wetland areas, appropriate documentation of design approval by the US Army Corps of Engineers will be required; for projects impacting lands within 25 feet of state waters shall require appropriate variances for Georgia Department of Natural Resources.

### **Section II WATER QUALITY REQUIREMENTS:**

#### **2.01**

The water quality of stormwater runoff depends on a number of factors including: magnitude and duration of rainfall events, soil types, time between storms, land use type and specific activity, illicit connections or illegal dumping, and the ratio of the runoff per volume to the receiving water flow volumes. The storm water management policy adopted by Augusta-Richmond County Commission recognizes that the use of structural and non-structural controls for stormwater management programs are beneficial in the controlling pollution of the receiving waters. Therefore, best management practices (BMP'S) are encouraged in stormwater plans in

project design and construction. BMP's may include a maintenance and activities schedule for drainage facilities, soil erosion and sedimentation control practices, etc. All developments must comply with the Soil Erosion and Sedimentation Control Ordinance, current edition, as minimum structural and non-structural standards for project design.

## **Section III LOCAL REGULATIONS:**

### **3.01**

In response to specific requirements in the Clean Water Act of 1993, Augusta has been given authority by the Georgia Department of Natural Resources, Environmental Protection Division to permit the National Pollution Discharge Elimination System permit program. The local program requires the use of best management practices based on the current Soil Erosion and Sedimentation Control Ordinance adopted by Augusta-Richmond County Commission. The application of these regulations includes the use in stabilization, mulching, straw, grass, silt fences, sediment traps, and other temporary/permanent structures for minimizing soil erosion and the transportation of sediment into receiving waters. All developers shall comply with these regulations.

## **PART III MATERIALS FOR CONSTRUCTION**

### **SECTION I STORM DRAINS:**

#### **1.01 General:**

For public systems, all storm drain pipe, manholes, junction boxes, catch basins, inlets, etc. and appurtenances shall comply with GA Department of Transportation construction standards and specifications. Additionally, bedding material, when required, and select backfill shall comply with these regulations. The following specific design criteria will be required for new developments:

#### **1.02 Design Guidelines:**

a. All storm drain pipe located under pavement or longitudinal pipe as part of the roadway drainage system shall be reinforced concrete pipe. A minimum class III reinforce concrete pipe shall be used. All concrete pipe shall be manufactured and installed in compliance with GA Department of Transportation standards and specifications. Concrete arch pipe shall only be allowed with special approval by the City Engineer.

b. Outside of right-of-way limits, other suitable pipe materials may be used. Installation shall be in accordance with GA Department of Transportation

construction specifications.

c. Catch basins, drop inlets, junction boxes, grate inlets, hoodback traps, storm manholes, etc. shall be constructed in accordance with GA Department of Transportation construction specifications and standards.

d. Catch basins installed along roadways with raised edge asphalt sections, shall include concrete transition lengths standards for construction. The construction of the transition curb shall be of concrete as per construction standards and tie into the raised edge asphalt. The face of the proposed catch basin shall be located at the back of the raised asphalt section "not at the gutter line".

e. Augusta recognizes that private developments may be designed and constructed in the County. Private developments not constructed in accordance with GA Department of Transportation Construction standards, as noted herein, can not be accepted into the county system for improvement and/or maintenance unless improved to minimum county standards and accepted by the county..

## **Section II CULVERTS:**

### **2.01**

Culverts shall be constructed of Class III reinforced concrete pipe, Class IV reinforced concrete pipe, as appropriate, or concrete box culverts. Design of said facilities shall be in accordance with GA Department of Transportation standards specifications and construction standards.

## **Section III SOIL AND ROCK STRUCTURES:**

### **3.01 General:**

Soil and rock structures shall include earthen embankments for roadways, earth and/or earthrock structures for dam construction, dikes, containment embankments, and structural earth berms for the support of facilities or structures, impoundment of water, or diversion of runoff. Earth and earthrock structures do not include landscaping berms. For earthen dam construction, sufficient design information regarding the construction of the proposed impoundment embankment shall be provided. This data shall include the suitability of the materials and design cross-sections to ensure geometric stability of the structure. Soil for embankments impounding water shall have at least 15% clay content and be compacted to a minimal of 95% of standard proctor dry density at or near optimum moisture content. For earthen structures, design data shall include sufficient information to indicate the stability of the soil structure and provisions to prevent piping, excess seepage, etc. Earthen structures that must comply with the GA Safe Dams Act shall be submitted to the Department of Natural

Resources Dam Safety Division for review.

Earthen structures will also include the construction of swales. The type of erosion control practices required for construction of swales will depend on the velocity of runoff for the design storm. Construction of swales shall be accomplished in accordance with the Manual for Erosion and Sediment Control in Georgia.

## **Section IV GRASSING**

### **4.01**

Temporary and permanent grassing are required to comply with the Soil Erosion and Sedimentation Control Ordinance adopted by Augusta-Richmond County Commission. Grassing schedules shall be submitted in accordance with the Manual for Erosion and Sediment Control.

## **Section V FENCING**

### **5.01**

Fencing is required around all impoundments designed as permanent stormwater runoff storage facilities to be dedicated to Augusta-Richmond County Commission. In some cases, a hold harmless agreement may be executed by the owner of the project to eliminate the installation of fencing for the subject stormwater storage facility (see Appendix). Where fencing is required, all fencing shall be 11 gage (minimal) and 6 feet in height. The fencing shall contain three (3) strands of barbed wire or ribbon wire to inhibit unauthorized access and shall include access gates, minimum 14 feet total width. All fencing shall include a top rail in accordance with GA Department of Transportation Standards.

## **Part III UPDATES**

This Development Document is to be updated annually by the Subdivision Review Committee appointed by the Richmond County Commission in October 1995.

This review and update will take place in June of each year.

## **REFERENCES:**

Augusta-Richmond County Subdivision Regulations  
Columbia County Subdivision Regulation Manual, April 1993  
Drainage Criteria Manual, City of Austin, Texas, Revised 1989  
Drainage Procedures Manual DeKalb County, Revised 1978



Environmental Criteria Manual, City of Austin, Texas, Revised 1991  
Highway Drainage Guidelines, AASHTO 1987  
Manual for Erosion and Sediment Control in Georgia, Fourth Edition, 1996  
Manual on Drainage Design for Highways, Georgia Department of Transportation, revised 1988  
Manual on Drainage Design Fulton County Department of Planning & Community Development, 1983  
Municipal Stormwater Management by Debo and Reese, 1995  
Regulation of Stormwater Management Systems, Saint Johns River Water Management District, Palatka, Florida, revised April 1994  
Urban Stormwater Management Special Report No. 49, American Public Works Association

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